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THE CUMMINS-ESCH BILL RETURNING THE RAILROADS

After more than two years of Federal control, during which time the public's belief in the ability of the Federal Administration to deal satisfactorily with the railroad situation has been rudely shaken, the railroads have returned to their private owners. The Esch-Cummins Bill providing for their return was reported from the House-Senate conference committee on February 5, was passed by both houses of Congress and was signed by the President on February 28.

At this time when the railroads are being returned it is very much the census of public and newspaper opinion throughout the country that the Government's administration of the railroads has fallen far short of materializing the fond dreams and alluring claims made by former ardent champions of government control and has permanently discredited government ownership in the United States. Passenger-train equipment, service, and schedules have never touched as low a point of efficiency nor as high a point of inefficiency in serving the public in all the history of railroad development in this country as in the last year. Freight service is notoriously slow, uncertain and undependable. Yet in the face of this general decline in the value of service rendered, all freight and passenger rates have quite generally been doubled and trebled.

An almost mad scramble characterized the final efforts of both Senators and Representatives to bring about an agreement upon the bill in conference, and in their hurry to effect a settlement desirable and fundamental measures in both bills which might well have been retained with wisdom and discretion were ruthlessly deleted, and the already overworked Interstate Commerce Commission smothered by being given almost blanket authority in the administration and regulation of railroad affairs.

The compromise bill is in some measures almost radical, in others quite conservative. The fundamental idea back of the bill is that advocated by the

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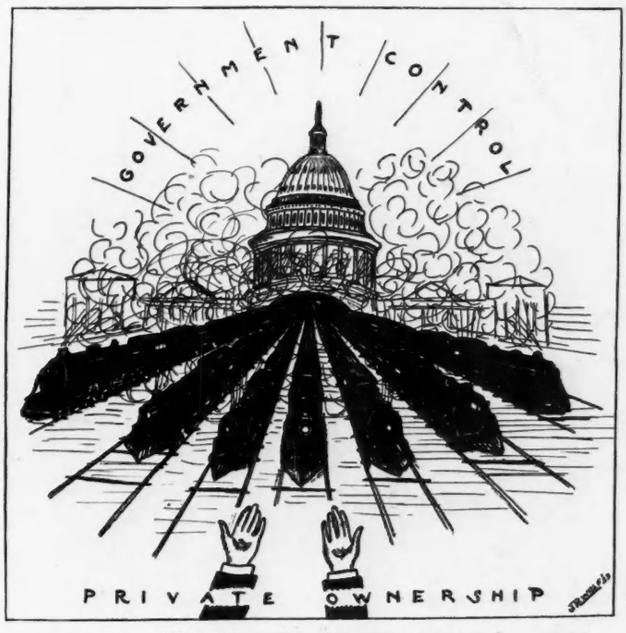


THE RETURN OF THE FLOCK

THE "SUPERPOWER" PLAN

At the eighth midwinter convention of the American Institute of Electrical Engineers, held in New York Feb. 19, general consideration was given to the "superpower" plan, for an investigation of which a congressional appropriation of $250,000 is asked. The project includes the electrification of all the railroads of the North Atlantic seaboard, and under it all of the industries in the section would receive their power from a system of power houses stretching from Boston to Washington.

Although a great part of the generating machinery now in use could be utilized, it would be necessary, in the opinion of engineers, to install new equipment to the capacity of 2,700,000 kilowatt hours, which, with 2,100 miles of high tension transmission, would cost about $442,800,000.

The advocates of the superpower plan assert that the benefits to be derived by the railroads, industry, and the public from its adoption are enormous.

QUALITIES FOR LEADERSHIP

By MATTHEW BRUSH, '01
President American International Shipbuilding Corporation

The greatest single requisite, in my opinion, for a man to be a leader is the willingness on his part to take responsibility and to have confidence in his judgment. He must, above all things, be able to handle men successfully, and to do this he must have the power and faculty of compelling their confidence in him. Successful leadership consists today in perfect teamwork and the most successful leader is he who can, with the power of analysis of men, surround himself with an organization where there is a perfect exchange between himself and his associates of ideas, comments and suggestions, with the ability on his part of inviting free and frank discussion or criticism by the members of his team and then arriving at a decision which the entire team will undertake to carry to a successful issue.

No one man can by himself be a successful chief executive of a large institution. He must pick men for their respective duties who themselves will create in their divisions a sub-division of the team, and who must have the confidence of their subordinates as he has the confidence of his chief executives. He must pick men who are not afraid of responsibility, and who have for him not only tremendous respect and confidence in his judgment, but who hold for him also a feeling of affection. He must be able to create an atmosphere of close, intimate association, where the men are not only not afraid or reluctant to come to him, but feel free to discuss any matters with him—frankly expressing their opinion and intensely and earnestly carrying out his decisions.

He must have for his team men who are big enough, strong enough, loyal enough, able enough and earnest enough to tackle their problems with the ultimate good of the team as a whole as their goal. He must pick men who work together, who do not think they know it all, and who are willing at all times to take counsel and advice from their associates and subordinates. Above all things, he must pick men who run their jobs and

(*Continued on Page 10*)

ELECTRICAL PRECIPITATION AS APPLIED TO CEMENT MILLS

By M. C. Turpin

Westinghouse Electric & Manufacturing Company

The dust and fumes usually discharged from the stacks of cement mills, iron furnaces and many other industrial plants, not only represent a waste of valuable material, but also frequently constitute a nuisance which it is exceedingly desirable to eliminate.

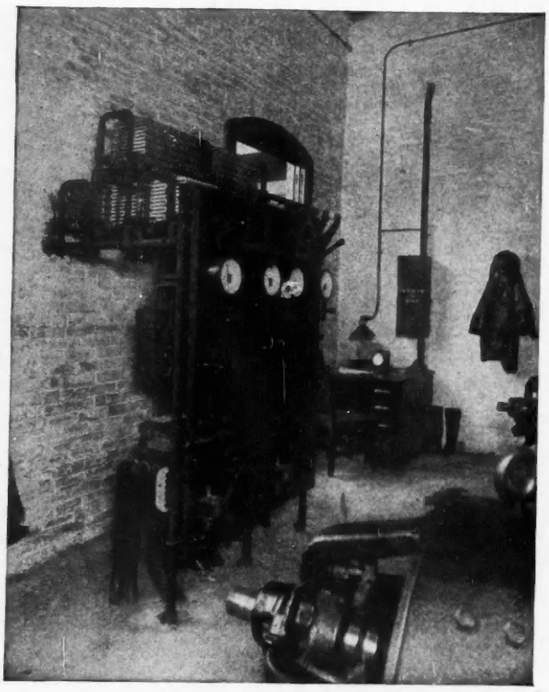
By means of electrical precipitation, which is unusually simple, economical and effective, potash is collected from the dust in cement plants, metal losses are reduced in copper and lead smelters, smoke nuisances in various kinds of plants are eliminated and in blast furnaces ore dust and potash are recovered. It is also used in gas plants for removing dust, tar and lamp black. The ability of this process to recover potash in commercial quantities from the vapors of cement kilns was a genuine surprise to the world and will undoubtedly have economic consequences of the greatest importance.

The process, which is the invention of Dr. F. G. Cottrell, now Chief Metallurgist of the Bureau of Mines, is exceedingly simple in theory and easy of application. It consists in passing the dust laden gases through an intense electro-static field which causes the solid particles in the gases to be precipitated on the positive and negative electrodes of the electric circuit. This is the same principle as exemplified in the familiar experiment in high schools physics when a pith ball attached to the end of a string is attracted by a piece of amber, rubber or glass, which has been electrified.

The process requires a high voltage direct or uni-directional current which may be obtained by several different methods. While it is possible to generate direct current at the potential usually required, from 25,000 to 65,000 volts, it is not practicable and the better plan is to step up the low voltage alternating current generally obtained from the local power plant and change it into a uni-directional current by means of a mechanical rectifier, which is similar in principle to the commutator of a direct current generator.

The method of application of the high voltage current to the dust or gases is comparatively simple, and may be explained as follows:—

A typical pipe treater in general consists of two large horizontal flues connected together by a number of small vertical pipes. Gases enter through one flue, pass through the verticle pipes and are discharged through the other flue to a stack, exhaust fan, or other draft producer. The gas is then exhausted into the atmosphere. Some treaters employ rectangular passages instead of pipes to connect the two flues. These are generally referred to as plate or box treaters. The principle of operation for all these types of treaters is the same.



Courtesy Westinghouse Elect. & Mfg. Co.

SWITCHBOARD BY WHICH THE CURRENT USED IN PITTING PROCESS IS CONTROLLED

The actual precipitation of the dust or fumes occurs in the vertical pipes referred to above. Carefully centered in each, is suspended a small wire or a small chain. These constitute the negative electrode of the treater system. The inside surface of the pipes constitute the positive electrode. Each wire or chain is carefully insulated from its pipe and from the ground, and is charged to a high potential usually at from 25,000 to 65,000 volts direct current. The tubes themselves are grounded. Thus within each pipe is created an intense electrostatic field. The gases passing through this field become ionized, and the ions travel with high velocity in a direction at right angles to the electrodes causing the field. These highly charged ions are continually colliding with the suspended solid and liquid particles in the gas, and the ions impart a charge of like potential to such particles, which in turn begin to travel towards the electrode of opposite polarity. Since the negative suspended electrode is of much smaller area than the electrode formed by the inside surface of the pipe there is much greater electrostatic stresses per unit of area in the neighborhood of the wire, and as a result far greater ionization about the wire. Thus the gas receives a static charge of the same polarity as the wire, and the solid or liquid particles in the gas receive charges of this same polarity which causes them to be projected against the inner surface of the pipes, where they tend to stick and accumulate until the electric power is turned off, after which the accumulation of dust is usually collected from the pipes by loosening it by rapping the sides of the pipes with mechanical hammers.

The dust falls down into hoppers from which it is loaded into bags. The dust comes out in a finely divided state and is entirely suitable for use as a fertilizer.

In the operation of a cement plant employing the electrical precipitation method of recovering potash from the cement dust, it is found that not only is the valuable material recovered that otherwise would be lost, but the production of cement has been improved and the fuel economy improved. Because of the necessity of closer attention to the kilns a better grade of clinker is obtained which seems to be coincident with the most efficient recovery of potash.

Under present conditions it is safe to assume that a recovery of at least 99% of the dust is being obtained in these plants using the Electrical Precipitation Process, from which it will be seen that employment of this process opens up a wide and profitable field for the cement mills of the country, and one that they will doubtless use.

DR. STEINMETZ ON FUTURE POWER SUPPLY

Dr. C. P. Steinmetz, of Schenectady, N. Y., gave his annual lecture recently before the Chicago Section, A. I. E. E., and Electrical Section, Western Society of Engineers, on "Power Supply and Generation of the Future."

In our civilization of today two things are vitally necessary, said Dr. Steinmetz. One of these is materials, the other energy. As regards energy, the question is how to obtain and how to supply it. In obtaining energy, man has called upon nature's most readily convertible sources of energy, coal (including oil and gas) and water power. Chemical and electrical energy may be transmitted, but for general distribution only electrical energy is available.

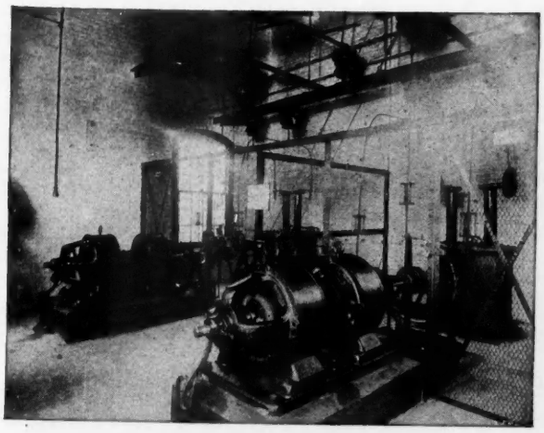
The modern industry of power supply is covering the country with transmission lines at high voltage, some of the generating stations being at the mines to eliminate coal transportation. There might well be more. In this country 800,000,000 tons of coal (including oil and gas) are consumed annually.

Consideration of water power as an alternative source of energy shows that if every drop of rain were utilized the water power would equal only about one fourth of that now supplied by coal.

Of course this could not be done but taking one fifth of that amount as available for power production through the use of dams and lakes, etc., (about 200,000,000 kw-yrs) and assuming that a ton of coal is equivalent to one kilowatt-year, it is seen that possible water power is only one-twentieth of the present ever increasing power supply derived from coal. But water power should replace coal where possible and would result in a big saving.

Turning to other sources of energy, Dr. Steinmetz next spoke of energy derived from wind and suggested windmills and small generators upon transmission-line structures as a possibility. Referring to tides, he said it would be necessary to change tidal energy to ordinary hydraulic energy, equivalent to a low head waterfall with a changing head, in order to secure results.

Solar energy, while not feasible today, presents vast possibilities for the future and 100 times as much energy, theoretically, is available from that source as from coal and water combined. He also touched on obtaining volcanic heat from shafts sunk into the earth, radio activity, the energy of atoms and divers other complex aspects of future power production.



INTERIOR OF GENERATING ROOM

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DR. STEINMETZ

MUNICIPAL FIRE SIGNALLING SIXTY YEARS AGO AND NOW

Something over sixty years ago the fire alarm telegraph was invented. Like many other inventions the first attempts seem crude viewed from today, yet also like so many other cases the basic principle of the first box is the principle that has survived until now.

The original box contained practically nothing but a telegraph key operated by a notched wheel that opened and closed the circuit. That principle, an electric current interrupted mechanically, still continues in use. The protection of this primary function has however developed the box until today the fire alarm box looks but little like its forefathers. The motive power is now supplied by clock-work instead of manually. The tripping lever is so arranged that once the mechanism is started it cannot be interrupted either through ignorance or malice.

Fire alarm boxes are arranged twenty or twenty-five on a circuit which forced the invention of the non-interfering device which prevents one box from cutting in on another while it is in operation and mutilating the signal. This invention was followed quickly by the invention of the successive feature which permits two or more boxes operated simultaneously to send in their signals over the circuit one after the other.

The change in the construction of the box has kept pace with the development of its functions. Efficient lightning arresters protect the box against foreign currents where the original box had no protection. Wood for insulation gave place to hard rubber to be succeeded quickly by slate and finally by porcelain. After countless experiments commercially pure silver has been decided on as the most efficient and dependable material for contact surfaces. The original cases of frail construction have been succeeded by double cast iron cases some of which have stood on the streets of cities for thirty-five years.

The changes in the central stations have been fully as great. The original Boston office was little more than a terminal point for the circuits carrying the street boxes and the circuits running to public alarms. Today with the tremendous increase in number of boxes the modern central office is as different from the original as the big modern telephone switchboard is different from the village switchboard. Individual, and in most cases isolated buildings, are provided to house the switchboard, batteries, recording sets, transmitters and repeaters. A corps of operators are constantly on duty and the engineering problems which have arisen have resulted in the creation of fire alarm engineering as a separate and specialized branch of engineering.

The growth of the fire alarm industry has been steady because the need of a swift errorless method of transmitting signals has always been clear. Swift and errorless describes briefly the fire alarm telegraph, and explains why the telephone and other devices have never been more than auxiliaries to the fire alarm telegraph system.

TO OUR READERS

Owing to lack of space the Alumni Column and the Current Articles of Interest Column do not appear in this issue. It is our intention to continue these features in following issues.

BI-MOTORED AIRPLANES IN MAIL SERVICE

By George M. Denkinger, M. I. T.

The accompanying illustration shows a modified DeHaviland mail-carrying airplane equipped with two 150 H. P. Hispano-Suiza engines. The adoption of a similar type of machine by the mail department constitutes a rather radical step in the Department's commercial application of the airplane. The Department proposes to utilize the Liberty motors which were made in huge quantities in this country during the war. It is planned to make use of two six-cylinder 200 H. P. Liberties which can be almost entirely constructed out of one twelve-cylinder 400 H. P. motor. It will be remembered that the DeHaviland war machine was equipped with a 400 H. P. unit. In this manner the Department will be able to salvage several hundred thousand dollars worth of DeHaviland-4 war planes together with several Liberty motors which otherwise would have to be disposed of for a fraction of their former worth.

It is claimed that a machine thus equipped can actually climb as well as maintain its altitude under full load, with but one engine running. The obvious advantages of a bi-motored machine are that the fire hazard is reduced by having the engine in the wing, away from the gasoline supply; and an increase in reliability is also obtained. It moreover furnishes a more convenient storing space for the mail in the fuselage proper, at the same time providing a better distribution of weight along the longitudinal axis. The placing of the motors on the lateral axis, however, lessens the maneuverability of the machine about that axis and tends to produce lateral instability. When the engines are placed in the wings, additional stresses beside direct air loads are imposed on that portion of the airplane structure. This necessitates the redesigning and strengthening of the wing members, with consequent increase in weight. When, in addition, it is considered that the weight of the two engines is in excess of that of a single unit of the same power, it is probable that the percentage useful load for either type remains constant.

If one engine fails it becomes extremely hard to maneuver such an airplane, especially in gusty weather, and it is extremely doubtful if any other than a three-engine machine can be properly maneuvered with one of its power units disabled. With regard to the performance of a two-motored machine versus a single-motored airplane of equal horsepower, the performance should not be radically different and the load-carrying capacity of the machine will, as noted, remain about the same. The main advantages of such a design are the increase in the safety of the pilot and the reliability of the machine as a whole.

CONTRACTING

By J. Wingate Rollins, '78.

A generation ago a contractor was generally a man with little technical knowledge, but one endowed with executive ability and good common sense. The problems of construction in those days were comparatively simple, if the question of doing difficult work in a short time was considered. As conditions gradually changed, and work became more difficult, contracting opened a field for technical men, and engineers began to take up the work, and this condition has progressed so that at the present time many of the best contractors in the country are engineers, or have engineers of high ability on their staff.

Having been on both sides of the work, having spent about 20 years in each branch of construction, the last period on contracting, my judgment is that contracting requires a man with a greater range of ability than engineering. Most any engineer can make a sketch of a pier 150 feet under water, or a foundation deep into quicksand and water, but it takes much ability, technical knowledge, resourcefulness and courage, to do the work successfully after the plans have been made.

A successful contractor on large work public or private, must be able to meet the principals, to handle the financial end of the business, of buying material and keeping accounts; all of the above outside his technical knowledge, skill and judgment in designing his plant and temporary work; and have the courage and perseverance to carry it on, for no great work fails to have its failures and discouragements.

Failure is no word for a contractor. He must "carry on" and do his work even though things go wrong, the elements and nature are often against him, and the financial balance is away on the wrong side. These conditions require courage to face, but when the end comes and a great work is done, something that all the world can see and admire, then comes the reward for all trouble, in the satisfaction of having overcome all obstacles, and built what may be a lasting monument to his courage and ability.

WESTINGHOUSE OPPORTUNITIES FOR TECHNICAL GRADUATES

Westinghouse opportunities for technical graduates are very thoroughly explained in an illustrated pamphlet bearing that title, recently issued by the Westinghouse Electric & Manufacturing Company.

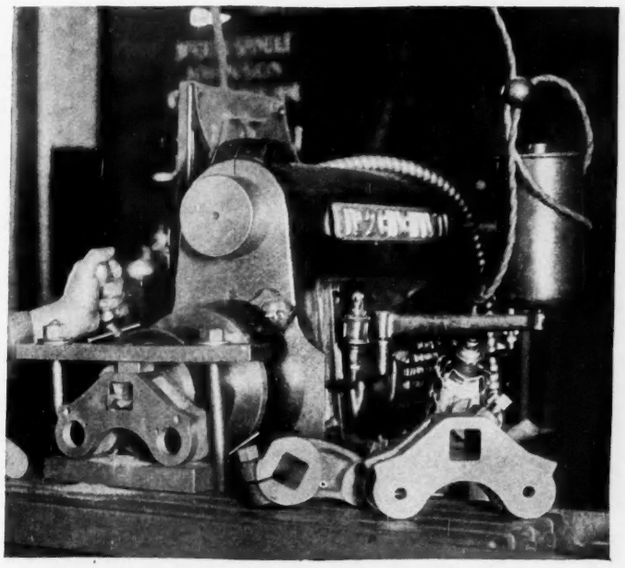
Copies of the booklet will be sent to anyone interested on application to the Educational Department of the Company at East Pittsburgh.

THE MODIFIED DE HAVILAND MAIL-CARRYING AIRPLANE —Courtesy of Aerial Age

MAKING THE SQUARE HOLE COMMERCIAL

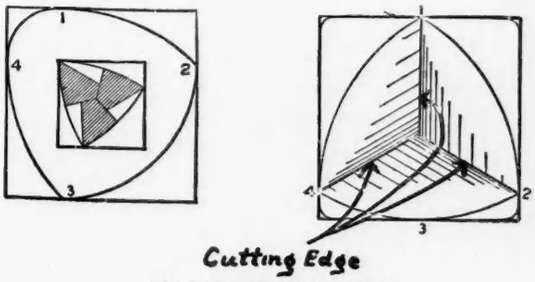
During the past few years a device has been developed, as useful as it is ingenious, which will drill a square hole through solid metal in a single operation. The device, which can be readily attached to any milling machine or drill press is a square hole drilling attachment based on the principal of the Cardan circles.

This tool, now merchandised by the Fairbanks Company and known as the "Radbore" head is of surprising simplicity as the accompanying cut will show. Figure 2 shows the principle of operation. Cutting edges which sweep across surface into which the drill is fed, are ground on end of drill of which figure 1-2-4 is a shank cross section. The drill operates inside of the square guide shown.



THE "RADBORE" IN OPERATION

The drills have a positive drive from the spindle of the machine and the cutting lips follow a path determined by the adjustable jaws of the head, so that no preliminary round hole is necessary. The cutters are so designed that there is no material in the bottom of the hole which is not removed by the cutting edges; therefore blind square holes can be obtained in one operation and without any subsequent finishing.



THE "RADBORE" HEAD

There are two designs in which this drill is made, one for the quick and accurate completion of sundry jobs, the other for heavier work and hence of greatest commercial value in the factory on production. The lighter type derives a hole with filleted or rounded corners, while the heavier type produces square holes with sharp corners. This latter type is of significant use in die work, the squaring of key-ways, etc.

The entire proposition of drilling square holes with the "Radbore" attachment has narrowed itself down to the rapidity of round hole drilling. Being a free cutting tool with sufficient chip clearance, a heavy pressure on the feed is unnecessary, and aluminum can be drilled as easily as the toughest steel, a perfect chip being thrown in either case. Additional advantages are those of obtaining a blind hole with a perfectly flat bottom; no chance of the drill being led off by sand or blow holes; no previous preparation required. Also since the drills are sharpened on the end, there is no loss in size resulting.

Numerous methods of machining and drilling square holes have been brought to public attention, from time to time, and have been frowned upon by practical engineers and manufacturers with just cause.

A NEW POWER PLANT AT NIAGARA FALLS

Work on the new hydro-electric development at Niagara Falls, which the Hydro-Electric Power Commission of Ontario started in 1918, is progressing at an expected rate of speed. A long canal is being built to carry water around the falls and through the power plant. Some little difficulty has been met in holding the slope in the deep cuts in the earth overburden, but this has not caused serious retardation and the prospect is now that the power will be available in 1921.

SECRET RADIO SIGNALLING

By Charles C. Henry, '22.

John Hays Hammond, Jr., has recently developed a system of military radio telegraph communication, which cannot be intercepted by any present form of radio receiver. While it is not known how he accomplishes this wonderful feat, it would seem that it is based on some method of superimposing radio frequencies. Such a system might operate after this fashion: If, for example, a continuously oscillating transmitter tuned to one hundred and fifty meters were to be modulated at desired intervals by a key-controlled circuit tuned to twenty-five meters, and properly coupled to the former circuit, a complex wave form would be emitted, and signalling on this system could be intercepted only by a receiver specially equipped to discard the one hundred and fifty meter carrier wave and heterodyne or rectify the twenty-five meter modulations which convey the elements of the Morse code. It would be almost impossible for an enemy to interfere with reception by any system of malicious jamming. Because of the inefficiency of the vacuum valve on very short wave lengths, especially constructed tubes might be particularly advantageous in the short wave circuits. One wonders if absorption to a marked degree would not be encountered were such a system installed amongst the metal rigging and gear of warships. While the employment of higher wave lengths would partially overcome this difficulty, it would greatly increase the chances of undesired reception.

THE AKRON INDUSTRIAL SALVAGE COMPANY

Members of 125 industrial concerns in Akron, Ohio, in an effort to effect a saving of materials during the war, formed an organization for the salvage of all usable waste called the Akron Industrial Salvage Co. The plan not only helped the government but was also a distinct source of income to the members themselves.

Now that the war is over and time is not vital, still more benefit is derived from the scheme. The members send all their waste materials daily to a common warehouse. Here the various kinds of waste such as metal turnings, paper stock, and scrap iron, are sorted and baled ready for sale.

There is a ready market for the large amounts of reclaimed material which the company had to sell. At the present time the concern realizes more than $6,000 per month from the sales, and is planning to build a large addition soon.

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AVIATION AND M. I. T.

On July 24, 1917 the national congress committed in sublime faith the most sublime folly in the whole history of the war. Its faith was given on the word of some six or seven men, and its folly consisted in the act of voting six hundred and forty million dollars, blindly and with none of the usual checks or safeguards, subject solely to the direction of these six or seven men, for the building up of our air force.

The act was a tribute to our American habit of idealizing our big men. Unfortunately however, the men selected proved not to be big men. Although, as it developed in subsequent investigations, they were not criminally guilty, they did prove their absolute incompetence for the task intrusted them. They dissipated the entirety of this enormous sum of money with the pitiful result, according to General Pershing's report, of less than ten combat planes delivered at the battle front up to the time of the signing of the armistice.

As a result of this folly we find ourselves in the deplorable situation which is ours at this time. Congress, having before it the painful example of its former munificence to the cause of aviation, is not likely to vote sufficient money to utilize economically the material we have accumulated during the war, not to speak of appropriating money with the object of furthering progress in aviation.

That this is one of the more important causes of the present situation is apparent when we compare ourselves with other nations whose governments are encouraging the development of aviation through generous appropriations for subsidies, mail and freight air lines, and every conceivable object which may result in the building of an air force with potential power for military use.

A further cause is the inertia of private enterprise, the natural disinclination all men have for taking up and backing a new and untried business.

These factors may explain the present situation but they cannot excuse it. It may not be long before we are in another war and are asking ourselves what we did during peace time toward furthering aeronautical preparedness. There is bound to be a certain pause, a certain inertia to be overcome before aviation is adapted to commercial uses and developed to an extent which will remove all fear of foreign air fleets in case of war.

The primary cause just now of this hesitancy, this want of confidence on the part of promotors of new enterprise, is the danger attached to flying and the uncertain performance of aircraft. These are things which can only be removed through research by men of imagination and ability conducted by an organization with ample facilities.

The Massachusetts Institute of Technology is an institution with these facilities, and is one which should feel the urge of the patriotic duty involved. The matter must be pushed. Aviation must be tided over this temporary slump. Aircraft manufacturers throughout the country are standing still. The government is doing nothing. It is up to someone to undertake the work.

What could be more fitting than that the Massachusetts Institute of Technology, the first institution in the country to start the development of aeronautical science, the first to establish a school for aeronautical engineers, should be the one to do this great service? If funds are lacking, even in spite of the effects of the recent endowment drive, contributions would be forthcoming from men anxious to see the need supplied, provided it were the Massachusetts Institute of Technology which should undertake the work.

Research to adopt the airplane to commercial uses must be started at once and carried on by competent hands, or we shall pay the terrible cost of our own procrastination when this country faces the next war.

LAMPY'S EXPOSÉ

The editors of the Harvard Lampoon have been very severely criticized for their publication of the recent "Laski" number. Their action has been variously characterized as slanderous, indecent, ungentlemanly, and unsportsmanlike.

Mr. Laski, the object of their attack, is an instructor and tutor in history, government and economics at Harvard University. He is an English Jew, was born and educated in England, and still retains his British citizenship. He is twenty-seven.

A short time ago Mr. Laski was the object of a great deal of criticism because of his action in addressing the striking policemen of Boston, and it is alleged, in sympathizing with their grievances. It is asserted that he has further used his position as an instructor to instil the principles of Bolshevism in the minds of his pupils at Harvard and Radcliffe.

The Harvard faculty have considered Mr. Laski's case on both these charges and have cleared him of them. We do not desire to question here the wisdom of their judgement. Nevertheless the affair has raised several interesting questions such as to what extent is the opinion and sympathy of the undergraduate body to be considered in the selection of instructors.

Freedom of speech in American universities is a thing which must be preserved. University instructors must be left free to discuss any matter in which they are interested, to instruct their students as to every phase of the subject they are teaching. This has been recognized for generations. Such a broad license as this, however, is not given without conferring an equally broad responsibility. Freedom of speech is granted, but it must be freedom to speak the truth. One sided, falsely colored arguments must be ruled out. Propaganda should not be tolerated. If a question is touched upon, every aspect should be treated fairly and impartially, and by men who have the perspective, the knowledge and experience, the balance necessary to do this.

There is a phase in this situation which has possibly escaped those who have condemned the editors of the Lampoon without considering their motives. The situation in our colleges and universities is not a usual one. The undergraduates, for the most part, have left their studies to take part in the Great War just ended. They have returned to their college walls feeling and articulating an Americanism, cherishing an ideal in respect to the true functions of government which it would be well for both our faculty members and our public servants to study. Meanwhile

the instructors have remained at home, have felt the pinch of war economy and have observed the countless injustices which always occur under a democratic government in time of war. The result has been a divergence of opinion between the faculties and their students. Faculty members the country over have become more radical, and their students more conservative than ever has been the case before. Some clashes were bound to occur.

The case at Harvard is not an isolated example. The situation is not far different in other American universities, and further clashes may be expected unless something is done by those in charge to govern radicalism on the one hand, and on the other to steer this unprecedented enthusiasm for things American among the students into the channels of good citizenship.

Greater care should be taken in the selection and allocation of instructors in every subject than that which allowed a man of radical tendencies, an alien, to fill the post of a teacher of government in Harvard University. It is not that every form of government should not be elucidated in our universities. There is no reason why we should be afraid to have university undergraduates know the truth on any subject. The point is that these matters should be presented by men who have the breadth and perspective to present them fairly and impartially. Universities are the home of radical thinking, but they should not be allowed to become the home of propaganda.

The study of government is one of the most important taught in our universities. Good citizenship is the first and most vital requirement of all college graduates. It is a quality which commands the greater importance because of the character of the times, the abandoning of conservatism and the haste to ill considered reforms advocated by intemperate men of all classes.

Good citizenship should be fostered by the universities. Government should be given the importance which belongs to it in the university curriculum, for without a true understanding of the principles of democratic government, good citizenship is doubtful. A chair of Government should be established in every university and an American, a man of high qualities believing in the principles of our American Government should be selected to fill it.

LICENSING ENGINEERS

Following the publication of the editorial of the above title in our preceding issue, our attention has been directed to an article in the January number of Mechanical Engineering, the journal of the American Society of Mechanical Engineers, which comments that not three but ten states have adopted legislation requiring the licensing of engineers. The article continues:

Some of these ten laws are so drawn as to include both engineers and surveyors and some include engineers and architects and one or two include engineers, architects and surveyors. Moreover, these laws are not at all uniform and in several instances are likely to prove seriously embarrassing and annoying to engineers whose activities extend beyond the limits of a single state. Because of the nature of professional engineering work the practice of an engineer frequently extends over several states and therefore it is vitally important, if there are to be state regulations for engineering practice, that these regulations be made uniform so far as possible and that the engineering profession unites in wisely directing such legisation.

The article goes on to describe the work of a committee of the Engineering Council created to study this subject, and gives an abstract of the "Recommended Uniform Registration Law" which the committee proposes be enacted by "each and every state" for the regulation of engineering, architecture and land surveying. Beside the manifest difficulty of securing enactment without amendment by every state in the union, there is still some doubt as to the necessity for legislation on this matter. In support of our advocacy of action by national engineering societies with the purpose of forestalling further state legislation, we have received the following letter from Doctor Arthur D. Little, former president of the American Institute of Chemical Engineers.

To the Editor,
The Tech Engineering News,
Dear Sir:

I have read with interest the editorial in the initial issue of The Tech Engineering News on the licensing of engineers. It is my understanding that the movement for the state licensing of engineers had its origin in the natural desire to check the tendency in some localities to appoint as engineers in charge of public works political workers rather than properly qualified engineers. This in itself is, of course, a wholly commendable purpose, and the public interest would doubtless be safeguarded by a requirement that public works should only be entrusted to engineers of demonstrated professional ability.

Whether a public examination is the best way to insure the possession of such ability is a question which is at least debatable, and it would seem as though the estimate of the professional associates of an engineer as evidenced, for example, by membership in those national societies that carefully maintain standards of admission might afford a saner basis for selection.

As the movement has developed its original purpose has been lost sight of or obscured, and in certain states the proposal now is to require all those who engage in engineering work of any sort to register and submit to a public examination before engaging in the practice of their profession. This applies to civil, mechanical, mining, and chemical engineers, and the examinations proposed are of a sort which aparently assume that the engineer in successful practice retains fresh within his memory all the details of textbook instruction on which his degree was based. This, as a matter of fact, is seldom the case, although his mind may have been greatly enriched by experience and practice. Among the numerous first rate chemical engineers with whom I have talked I have found none to whom the plan commended itself. It seems to be the general opinion that the effect of these laws will simply be that men who have demonstrated their competence by performance will keep out of these states rather than submit themselves to an academic inquisition of the sort proposed and that where such laws obtain, chemical engineering work will pass into the hands of recent graduates of limited practical experience, if any.

Chemical engineering work, moreover, is coming more and more into the hands of large organizations since the field is altogether too wide to be covered adequately by any one man. Can you conceive of a greater nuisance to such an organization than that of being obliged to put forward for examination each man to whom it proposes to assign field work on a Michigan job, for example? Any such organizations domiciled in Michigan will find themselves hampered and restricted in the selection of specialists for their staff, since many of the most competent of these either could not or would not attempt to pass such an examination. Moreover, since the states themselves are rarely concerned with the work of the chemical engineer the real effect of these laws is to limit unjustifiably the range of selection of those individuals or corporations who may wish to employ a chemical engineer and who are in position to know which of such engineers are qualified by performance to conduct their work.

Yours very truly,
A. D. LITTLE.

CORRECTION

In the article Paper from Bagasse published in the first issue it was stated that the maximum temperature reached in the acid process for pulp making was 10°C. This should read, 150°C.

CONCRETE WORK IN WINTERTIME

By George F. Gokey '21.

It wasn't many years ago that contractors believed it impossible to run concrete construction during the coldest winter months.

Today a great many successful builders have shown that the idea of shutting up shop for the winter is all wrong. Some very large construction companies have even gone so far as to advertise themselves as specialists in cold weather work.

Recently a packing building right on the water front at Portland, Maine, was built during the middle of the winter. Surely then there can be no reason why similar work cannot be carried on throughout the country.

Cold weather concrete work naturally is somewhat more expensive than warm weather work, but the extra costs are not excessive. A number of contractors have figured that this additional cost will not run beyond 10 per cent., although, of course, this increase depends a great deal on local conditions and it would not be fair to set any general average.

Cold delays the hardening of concrete. The change is noticeable even before the thermometer drops to the freezing point. It is necessary to provide by artificial means a temperature that will allow the concrete to harden without repeated freezings and thawings, and protect the concrete somewhat longer than it has to be protected in warm weather.

As a rule, concrete will not show any serious effects from freezing if after it thaws it is not allowed to freeze the second time. It is better to protect the concrete from freezing anywhere from two whole days to five days, depending on the degree of the cold.

Sand and gravel can be easily heated. One method is to heat the sand and gravel in a large cylinder by means of a fire, while the other method is to thrust into the piles of sand and gravel coils of steam-heated pipe. As cement forms a relatively small part of the mixture it is unnecessary to heat that.

Water can be heated in tanks or kettles over a fire, or it can be heated by steam. Exhausts from auxiliary engines is the general method of supplying the necessary steam in the latter metod. A temperature of 1500 F. is usually sufficient to heat the sand and gravel. Excessive heats may be injurious to the limestone present.

The metal forms should be warmed with steam jets so that they may not chill the newly poured concrete.

Such concrete work as floors, walks, roadways, etc., can be covered with straw, bags, canvas, etc., providing they are securely fastened to keep them from blowing away. Irregular and unlevel concrete surfaces are best protected by straw. Canvas is usually used to secure the straw. Other concrete work such as walls, columns, and other upright structures can be protected by means of a thick layer of straw and canvas or boards used to hold the straw in place. Sometimes it is practicable to use wooden housings over certain portions of newly poured concrete work, and heated by means of an open fire to allow the concrete to set before it has a chance to freeze.

The use of salt in the mixing water is not advised as a general practice. In the first place it is not always effective when the temperature is likely to fall 10° or more below the freezing point. According to best practice it is not advisable to use more than 10% salt. If more is used it may injure the concrete. Also the salt will retard the setting of concrete and will corrode the re-inforcing steel and cause white deposits on the finished concrete work.

No chemicals should be used to hasten the setting of the concrete. It is always best to allow the concrete to set as it would ordinarily.

Thin floor slabs, beams, columns, sidewalks, driveways, etc., have a large surface area compared with their volume. Therefore, they must have more protection than bulky work such as foundations, abutments, heavy walls, etc.

Frozen concrete has much the appearance of thoroughly hardened concrete. When struck with a hammer it will ring as if firmly set. The best test is to subject it to a flame from a plumber's blowtorch or a jet of steam or hot water. If the mixture is merely frozen, the water will melt and show the true condition of the work.

THE UNIT CAR

Gray & Davis Co., of Cambridge, Mass., is sponsoring a new departure in the railroad line. They are putting out a unit steam car, that combines locomotive, coach, and baggage car all in one.

It is designed for operation on branch roads, where traffic is light, and companies are losing money by operating the two-car train; and on interurban lines where trolley cars are used at present. It has proved its usefulness by two and a half years of operation on the White River Junction Railroad of Vermont, running in that time, more than 80,000 miles. The shops are working unsuccessfully now to keep up with the orders for new cars. The demand is large and increasing, and steps will have to be taken to increase the output.

The advantage of the car is its low cost, low initial cost and low maintenance cost. The present price is $25,000 f. o. b. Boston. Compared to this is $40,000 the price of the interburban trolley car. In the case of the locomotive and coaches, the price is enormously greater. The average cost of operation of the unit car is only ten cents per car mile. The cost of trolley cars is 27c per car mile, and again, in the case of railway cars drawn by locomotive, although no figures are available, the cost is larger.

The car is operated by two men, motorman and conductor. Its motor is constructed along the lines of the Stanley Steamer, to burn either crude oil or kerosene. It will average four miles on a gallon of kerosene, at a speed up to sixty miles per hour on level and fourteen miles on the maximum grade. Its entire mechanism is simple with nothing to get out of order. The car is undoubtedly something that will be heard from in the future.

A NEW SOURCE OF ENERGY

There has appeared on the fuel market a new source of energy—that is, a new combination of old sources in the form of a colloidal suspension of coal particles in fuel oil. This furnishes a readier and cheaper fuel and makes possible the use of the poorer coal veins for the coal content. It can be sealed against combustion, has a greater heat content per unit weight than either coal or oil, handles as simply and easily, is self-quenching in water, burns without ash, yet is capable of throwing up the densest of smoke screens by the proper manipulation of the air registers on the furnaces. This feature is of use in naval warfare.

It was developed by the Submarine Defense Association, a private concern, with the assistance of the United States Navy and the British Admiralty to combat the scarcity of fuel during the last year of the war.

Many failures had come from attempts of a similar nature for the same reason that lemon seeds fall to the bottom of a glass of lemonade—gravity. But Mr. Linden W. Bates by first pulverizing the coal to nearly molecular fineness and perfecting a suspending ingredient—a **fixateur**—was able to overcome gravity and keep the coal in suspension in a sort of colloidal form. It

(Continued on Page 14)

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QUALITIES FOR LEADERSHIP.

Continued from Page 1

who come to him with definite, crisp, constructive, well thought out and well explained matters of importance, and under no circumstances, at any time, ever come to him and ask what they shall do, with a definite idea of their own of what should be done.

Leadership today in any large institution requires intense application, complete control of one's feelings, the power of analysis of individuals, and above all the power to make the members of his team feel at such ease and feel in such a way towards him that they are thoroughly comfortable and frank in their discussion of problems with which they are confronted.

The greatest leader of men would be he who could succeed without having to issue instructions or orders, but who, in general discussion with the members of his team as to policy and procedure, could convey to his men the general scheme of operation, as well as the specific result to be obtained, and then have the respective members of the team carry out the scheme according to their best judgment, coming to him for advice, counsel or help. In other words, the successful leader is he who puts himself in a position of endeavoring to help his heads of divisions and his heads of departments run their jobs, instead of their helping him to run his job. I have in mind very clearly an instance of my own experience, where my predecessor had so impressed his subordinates with the importance of their subserviency, that in my first interview with one of them he spent all his time, all his thought, and all his energy thinking of how he should act in the office and conduct himself to show proper respect to a superior officer, and how he could say things which would most please me, with the result that he had left no thought, time or energy for consideration of the question we were discussing. It took me months to untrain this man so that he would come into the office as a co-worker and not as a slave.

A member of the team can have in-

timate, close, cordial even friendly relations with the leader and still not break down any attitude of respect or courtesy. The same spirit of gentlemanliness should exist between the leader and his men in an office as would exist in his club or home. The leader holds it entirely within his power to compel such an association by his poise, attitude and courtesy and in the choice of his men.

The resourcefulness of men is amazing when once they are made to feel they are an integral part of a machine of which the leader is the head, and when they then tackle their problems they do so with that extra ten-per-cent of ability, energy and earnestness of purpose, which money cannot buy and which can only be secured by the leader himself being the right type.

A big leader must, to carry out the above principles, select men who are "go-getters". He must select men, who when assigned a duty, are given instructions as to the result to be obtained, and who, with all the benefit of the judgment of their chief and their associates, go out and tackle their task, and as we say "go get what they are after". You cannot buy with money that kind of service, but by all means do not fail to recognize it as far as is possible with proper compensation.

It must always be realized that the character, ability and attitude of the leader is immediately imitated by his immediate subordinates and then permeates down through the entire organization. He must realize that his attitude towards his general salesmanager, for instance, is identically the same attitude as that officer shows towards his salesmen and his salesmen show towards the customer. I cannot possibly too strongly emphasize the importance of a leader always being a gentleman and recognizing the importance of courtesy. Merely because one man happens to be a leader and another man the subordinate,is no reason why the chief should not show him the same consideration and courtesy that he would to a stranger coming into the office. In other words, the successful leader in the world is he who knows how to pick men and after once they are picked, knows how to treat them. Teamwork is the watchword of successful leadership and the most successful leader is he who can create in his team the same relation that exists between a successful football team and its captain. We all know that in a football game today, individual star play does not win the game, but the team that has a captain who, in the first place, knows how to play football himself and who does not ask his men to do things which he himself is afraid to do, who has every member of the team not only loyal to him but actually love him, who shows no favoritism towards individual members of the team and who realizes that there is plenty of credit and glory for each member in the success of the team as a whole—is the team that wins the game.

In every respect is this equally true of a successful industry or public utility institution.

It, of course, is needless to say that a leader must be one-hundred-per-cent honest with his men and they equally so with him. He must always make them realize that they are receiving a square deal. He must select men whom he can freely take into his confidence and trust implicitly. He must be able to look them in the eye and have them see no mud in the bottom of his eye, nor he see any in the bottom of theirs. The old period of aloofness on the part of the chief is a thing of the past.

The greatest man, in my opinion, that the United States has produced, from the standpoint of leadership, was the late Andrew Carnegie. Run over in your mind Carnegie's original thirty partners, composed of such men as Charles M. Schwab, William S. Corey, H. C. Frick, A. C. Dinkey, A. R. Peacock, L. C. Phipps, James Galey, Thomas Morrison, P. T. Berg, H. P. Bope, Joseph E. Schwab, Daniel Clemenson, Homer J. Lindsay, A. C. Case, James Scott, Captain L. T. Brown, E. F. Wood, James Hunter and E. A. Hunt. It is interesting to note that he was one-hundred-per-cent perfect in this capacity, for every single one of these original men he selected as young men, to act as chiefs of his various mills, have been successful to the nth degree, in respect to worldly goods, popularity in the eyes of the world, and last, but by no means least, big human men. It was unquestionably Carnegie's ability to not only pick men, but to handle them, that achieved for him the marvelous success which he did achieve before he died.

When a man like Mr. Schwab, who was a member of Mr. Carnegie's team, says forty years after his association with Mr. Carnegie, "No man has had a greater influence on my life than Mr. Carnegie", that is evidence that the leader was a one-hundred-per-cent leader. Mr. Carnegie also had the skilled intellect and the skilled faculty of enlisting the people who were skilled in various arts, for he was not a skilled chemist, or skilled mechanic, or

Continued on Page 14

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The regular courses are of four years' duration, and lead to the degree of Bachelor of Science. In most courses the work may also be distributed over five years by students who prefer to do so. Special students are admitted to work for which they are qualified; and the degree of Master of Science, Doctor of Philosophy, and Doctor of Science are given for resident study subsequent to graduation. Opportunity for research is offered in all the departmental laboratories, in the three recently established Research Laboratories of Applied Chemistry and Physical Chemistry, and in the Sanitary Research Laboratory and Sewerage Experiment Station.

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PROFESSOR ALLYNE L. MERRILL, Secretary of the Faculty,
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The Esch-Cummins Bill

Continued from Page 1

Associated Industries of Massachusetts and the Massachusetts Chamber of Commerce before both Senate and House committees on railroad affairs, namely, a method of utilizing the excess earnings of the stronger lines to strengthen the credit of the weaker. It provides for a labor arbitration board of nine members appointed by the President whose duty it will be to settle all disagreements on wages, strikes, or lockouts arising between the owners or operators and the men. It further provides for an increase in the membership of the Interstate Commerce Commission from nine to eleven members and greatly widens and increases their powers and jurisdiction. A "long and short haul" provision for rate making is included in the bill, providing that a longer haul be made at a lower rate than a short haul if competition of carrying requires it, further providing that no change either in intra- or inter-state rates may be made before September 1 except by order of the Commerce Commission. Permission is granted for the regional consolidation of railroads under a general plan of consolidation to be prepared by the Interstate Commerce Commission, the design being to bring only consolidation units of equal financial strength into competition with each other. Finally, the earnings of the railroads are guaranteed for the six-month period following their return and a revolving fund of five hundred millions is established from which to make loans to needy roads and to pay claims growing out of Federal control.

The earnings of the roads under the Esch-Cummins Bill are fixed for a period of two years at five and one-half per cent. based upon the aggregate value of the railroads' property. Freight and passenger rates will be set by the Interstate Commerce Commission to yield this return. An additional one-half of one per cent may be set aside for improvements and developments. All earnings in excess of six per cent. will be equally divided between each carrier's reserve fund and the Federal railroad contingent fund for the benefit of non-paying roads. Determination of the aggregate value of the property of the various roads is left to the Commerce Commission with adequate provision for the examination of the property investment accounts of individual roads. The bill further provides for the regulation of security issues by the Interstate Commerce Commission and a general control over all policies of expansion and amalgamation.

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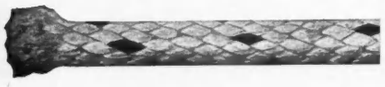

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A New Source of Energy

Continued from Page 8

was tested just before the signing of the armistice and is now ready for commercial use.

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The fuel will flow in pipes under pressure and will atomize readily in old equipment of nozzles. It will remain suspended for months and only needs a slight stirring at the end of that time.

Qualities for Leadership

Continued from Page 11

skilled engineer, but as Mr. Schwab says of him, "While it may be an easy thing to enlist the interest of such men in an enterprise, it is quite a different thing to get their best efforts and support. In that Mr. Carnegie was paramount over all men I have known".

Another evidence of his powers is shown in his policy of approval rather than of criticism. You ask me to suggest the qualities necessary for leadership, which question, in my admiration for Mr. Carnegie and his great team, is best answered by Mr. Schwab, who stated, "when ships were so badly required by our nation and the world, I was entrusted with the direction of that affair, and the only thing I did was to follow the example that Mr. Carnegie taught me many years ago, which was to stop criticism and to give people who were doing the work encouragement and approval for what they were doing".

Persuade your men under your leadership, whether it be two-thousand, twenty-thousand, or more, to work with you and not for you and you will be a successful leader.

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Now an army of 30,000 men and women work where General Washington camped.

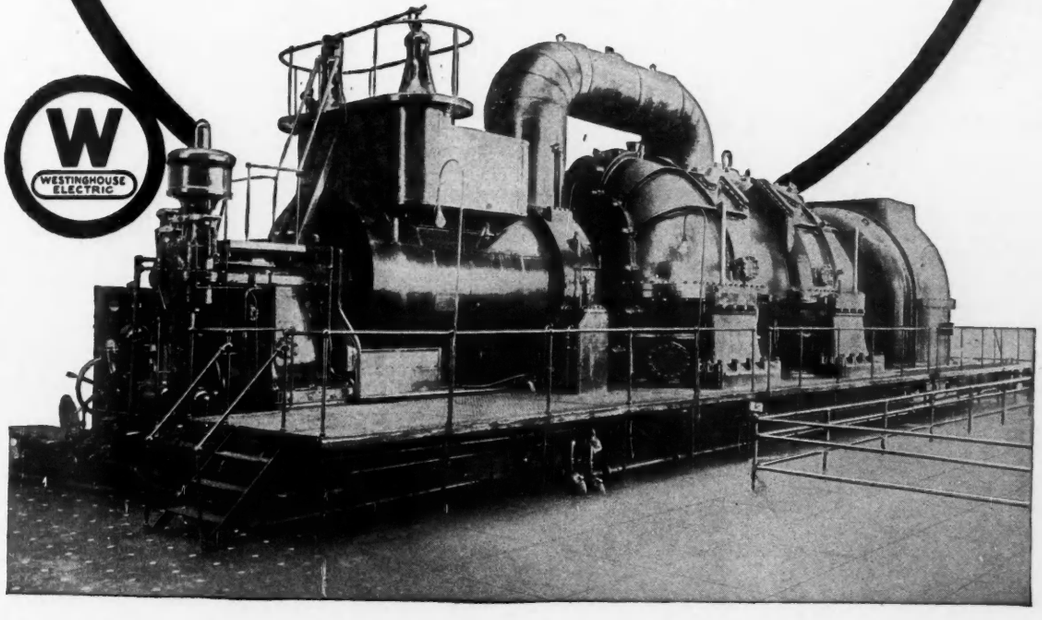
A Development Which Revolutionized Power House Practice

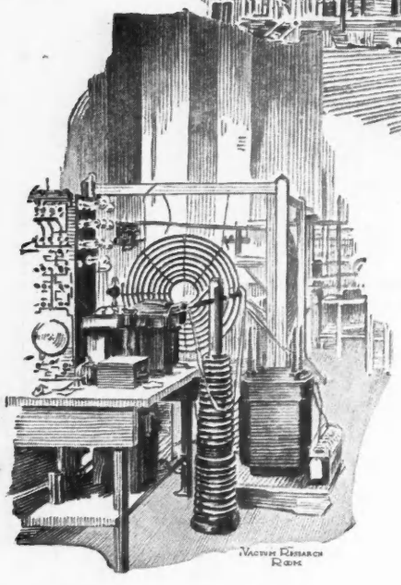
It was in this historic valley that the first commercially successful turbine-driven Alternating-Current Generator was developed under the direction of George Westinghouse. It was tested in the East Pittsburgh Shops in 1896. The splendid operation of this, and two duplicate machines installed a year later, sounded the death knell of the reciprocating steam engine—then in almost universal use.

The steam turbine has effected remarkable savings—one of the most evident of which is floor space—the turbine-generator occupying from one-fourth to one-sixth the space occupied by the reciprocating engine. In our large cities, with floor space valued at thousands of dollars a square foot, this is a consideration of great importance.

Ever since its organization, the Westinghouse Electric & Manufacturing Company has been foremost in the development of steam and electrical apparatus.

Westinghouse Electric & Manufacturing Company,
East Pittsburgh, Pa.





Some of the General Electric Company's Research Activities During the War:

Submarine detection devices
X-ray tube for medical service
Radio telephone and telegraph
Electric welding and applications
Searchlights for the Army and Navy
Electric furnaces for gun shrinkage
Magneto insulation for air service
Detonators for submarine mines
Incendiary and smoke bombs
Fixation of nitrogen
Substitutes for materials

The Service of an Electrical Research Laboratory

The research facilities of the General Electric Company are an asset of world-wide importance, as recent war work has so clearly demonstrated. Their advantages in pursuits of peace made them of inestimable value in time of war.

A most interesting story tells of the devices evolved which substantially aided in solving one of the most pressing problems of the war—the submarine menace. Fanciful, but no less real, were the results attained in radio communication which enabled an aviator to control a fleet of flying battleships, and made possible the sending, without a wire, history-making messages and orders to ships at sea. Scarcely less important was the X-ray tube, specially designed for field hospital use and a notable contribution to the military surgical service. And many other products, for both combatant and industrial use, did their full share in securing the victory.

In the laboratories are employed highly trained physicists, chemists, metallurgists and engineers, some of whom are experts of international reputation. These men are working not only to convert the resources of Nature to be of service to man, but to increase the usefulness of electricity in every line of endeavor. Their achievements benefit every individual wherever electricity is used.

Scientific research works hand in hand with the development of new devices, more efficient apparatus and processes of manufacture. It results in the discovery of better and more useful materials and ultimately in making happier and more livable the life of all mankind.

Booklet, Y-863, describing the company's plants, will be mailed upon request. Address Desk 37

General Electric Company

General Office Schenectady, N.Y.

Sales Offices in all large cities.

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